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Attorney Docket No. 56575 (71987)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of:

APPELLANT:	C. Huang et al.		
U.S. SERIAL NO.:	09/982,347	GROUP:	2822
FILED:	October 18, 2001	EXAMINER:	I. Soward
FOR:	FLASH-PREVENTING SEMICONDUCTOR PACKAGE		

CERTIFICATE OF EXPRESS MAILING

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Michelle. P. Chicos

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Sir:

APPEAL BRIEF

This is an Appeal from the Final Rejection of March 29, 2004 of claims 8-12 of the above-identified application. Three (3) copies of this Appeal Brief are enclosed.

FEE FOR APPEAL BRIEF

The fee for filing this Appeal Brief in the amount of $330.00 is being submitted herewith in the form of a check payable to the Commissioner for Patents.

It is Appellant's belief that no further fees are due in connection with the filing of this Appeal Brief.

Nevertheless, if for any reason a fee is required, a fee paid is inadequate or a credit is owed for any excess fee paid, the Commissioner is hereby authorized and requested to charge and/or credit Deposit Account **04-1105**, as necessary, for the correct payment of all fees that may be due in connection with the filing and consideration of this Appeal Brief.

REAL PARTY IN INTEREST

The real party in interest is **Siliconware Precision Industries Co., Ltd.**, of No. 123, Sec. 3, Da Fong Road, Tantzu, Taichung, Taiwan R.O.C., which is the Assignee of the entire right, title and interest in and to the above-identified United States Patent Application by virtue of an Assignment recorded in the U.S. Patent and Trademark Office on October 18, 2001 at Reel 012277, Frame 0574.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known to Appellant, Appellant's legal representative or the Assignee that will directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending Appeal.

STATUS OF CLAIMS

The claims presently under Appeal in the above-identified application are claims 8 through 12 as they stood upon entry of an Amendment filed on January 2, 2004. Claims 1-7 were canceled without prejudice in an Amendment filed on July 25, 2003.

The claims presently under Appeal are reproduced in the attached Appendix for the convenience of the Board of Patent Appeals and Interferences.

STATUS OF AMENDMENTS

No response or amendment has been filed after receipt of the Final Office Action.

SUMMARY OF INVENTION

The subject invention is directed to a semiconductor package in which a semiconductor chip is mounted on a substrate and encapsulated by an encapsulant. The encapsulant is fabricated by injecting a molding compound into a molding cavity of a mold, where the molding cavity is formed with a plurality of recess portions at corner positions thereof, each recess portion having a smaller height than the molding cavity and connected to an air vent of the mold. As a result, the encapsulant is formed with a plurality of outwardly-extending portions by filling the recess portions with the molding compound, and the outwardly-extending portions are located at positions corresponding to the corner positions of the molding cavity. The claimed invention is described in greater detail below with reference to the Appellant's Specification.

Claim 8 recites a semiconductor package, comprising a substrate mounted with at least one semiconductor chip thereon and electrically connected to the semiconductor chip. With reference to FIG. 3B, a semiconductor chip 22 is mounted on a substrate 20 by a plurality of solder bumps 21, which provide electrical connections (see Specification at page 6, lines 11-19).

Claim 8 also recites "an encapsulant formed by a molding compound injected into a molding cavity of a mold for encapsulating the semiconductor chip mounted on the substrate..." FIG. 3B depicts an encapsulant 29 that encapsulates the semiconductor chip 22 mounted on the substrate 20 (see Specification at page 6, lines 16-17). As recited in claim 8, the encapsulant 29 is formed by a molding compound injected into a molding cavity 252 of a mold 25 (see Specification at page 7, lines 5-10; FIG. 5). Referring to FIG. 5, the molding cavity 252 is formed with a plurality of recess portions 28 at corner positions 253 of the molding cavity 252 (see page 7, lines 15-18). The recess portions 28 have a height h that is smaller than a height H of the molding cavity 252 (see page 7, lines 18-19; FIG. 5) (i.e., the recess portions are "dimensioned to be relatively smaller in height than the molding cavity"). The recess portions 28 are connected to air vents 27, thereby interconnecting the recess portions 28 and outside of the mold 25 (see page 7, lines 12 and 15-18 of Specification; FIG. 5).

Claim 8 further recites that "the encapsulant is formed with a plurality of outwardly-extending portions by the molding compound filled in the recess portions of the molding cavity, and the outwardly-extending portions are located in positions corresponding to the corner positions of the molding cavity." As shown in FIG. 3B, the encapsulant 29 is formed with a plurality of outwardly-extending portions 28, which are located at positions corresponding to the corner positions 253 of the molding cavity 252 depicted in FIG. 5 (see page 6, lines 16-19 of Specification).

The Appellant's claimed invention can provide significant benefits. After the molding resin 29 flows into the recess portions 28 at corner positions of the molding cavity, the relatively smaller height of the recess portions as compared to the molding cavity causes the molding resin to more rapidly absorb heat transmitted from the mold 25, thereby increasing the viscosity and decreasing the flow rate of the molding resin (see page 7, line 25 to page 8, line 3 of Specification). As a result, the slowed-down molding resin 29 can be prevented from flashing out of the air vents 27 (see page 8, lines 3-4).

ISSUES

The following issue is presented by this Appeal:

Are claims 8-12 unpatentable under the terms of 35 USC 103(a) over FIGS. 1 and 2 of the application in view of U.S. Patent No. 6,069,408 to Honda et al.?

GROUPING OF THE CLAIMS

Claims 8-12 stand or fall together.

ARGUMENT

Claims 8-12 were rejected under 35 USC 103(a) as being unpatentable over "Admitted Prior Art Figures 1-2" in view of U.S. Patent 6,069,408 to Honda et al. (hereinafter "Honda"). The combination of FIGS. 1 and 2 of the application in view of Honda does not teach or suggest the Appellant's claimed invention as recited in claim 8.

A. Prior Art FIGS. 1 and 2

Prior Art FIGS. 1 and 2 of the application depict molded underfilling technology disclosed in U.S. Patent No. 6,038,136. As shown in FIG. 1, a flip-chip ball grid array (FCBGA) semiconductor package 1 includes a substrate 10 having a chip bonding area 102 predefined on a front surface 100 of the substrate 10, a semiconductor chip 12 attached to the substrate 10 in a flip-chip manner via a plurality of solder bumps 11, and an encapsulating material 19 for encapsulating the semiconductor chip 12 and the solder bumps 11 (see Specification at page 2, line 19 to page 3, line 1).

A cavity between the semiconductor chip 12 and the substrate 10 is underfilled during a molding process, whereby the encapsulating material 19 is injected into a mold with a plurality of air vents 17 connected to the atmosphere for ventilating excess air (see FIGS. 1 and 2;

Specification at page 3, lines 5-10). However, because the encapsulating material 19 has a low viscosity and fine fillers, it can flash around the air vents 17 as a result of the molding process, as shown in FIG. 2, which adversely affects the quality and appearance of the FCBGA semiconductor package 1 (see page 3, lines 10-14).

In the Final Office Action of March 29, 2004, the Examiner cited the following elements of FIGS. 1-2: a semiconductor chip 12 mounted on a substrate 10, an encapsulant 19 injected into a molding cavity for encapsulating the semiconductor chip, and air vents 17 formed in the mold for interconnecting corner portions to outside the mold (see Final Office Action, page 2, last paragraph).

However, the Examiner acknowledged that FIGS. 1 and 2 "fail to teach a molding cavity formed with a plurality of recess portions at corner positions thereof, and the recessed portions are dimensioned to be relatively smaller in height than the molding cavity; and a plurality of outwardly-extending portions located in positions corresponding to the corner positions of the molding cavity" (page 2, last line to page 3, line 4 of Final Office Action).

B. Honda reference

Honda discloses a device having a semiconductor chip 11 and electrode members 13A mounted on a holding board 19A/19B (see FIGS. 8 and 11, as cited in the Final Office Action). For example, FIG. 8 depicts a sealing process in which the holding board 19A is used as part of a mold, and a resin package 12 is formed for sealing the semiconductor chip 11 on the holding board 19A (see column 10, lines 32-36). As described in column 10, lines 63-67, in a subsequent separating process, "the resin package 12 separates from the holding board 19A together with the electrode members 13A." In Honda, the electrode members are firmly held to the resin package and will not separate from the resin package, which improves reliability of the semiconductor device (see column 2, lines 35-40).

C. Claim 8

Claim 8 of the Appellant's claimed invention requires a molding cavity "formed with a plurality of recess portions at corner positions thereof ... such that the encapsulant is formed with a plurality of outwardly-extending portions by the molding compound filled in the recess portions of the molding cavity."

In the Final Office Action, the Examiner stated that the left side of reference numeral 23 corresponds to both "a plurality of recess portions at corner positions" and "a plurality of outwardly-extending portions" as recited in claim 8. This is an improper reading of the Honda reference.

In Honda, reference numeral 23 corresponds to "upper-mold 23," which along with lower-mold 24 constitute a mold 22A for forming resin package 12 (see column 10, lines 37-42). The upper-mold 23 defines a cavity 26 and a gate 33 through which sealing resin 25 is filled into the cavity 26 (see column 10, lines 43-45). Upon completion of the sealing process illustrated in FIG. 8, the resin package 12 remains attached to the holding board 19A, as shown in FIG. 9, prior to a separating process for separating the resin package 12 from the holding board 19A (see column 10, lines 63-67).

Honda does not teach or suggest "a plurality of recess portions" formed at corner positions of a molding cavity, or "a plurality of outwardly-extending portions" of a molding compound filled in the recess portions, as recited in claim 8.

In Honda, reference numeral 23 corresponds to an "upper-mold" which forms part of the mold 22A. Honda does not teach or suggest "a plurality of recess portions at corner positions" of a molding cavity. Moreover, there is no teaching or suggestion that the left side of the upper-mold 23 near the gate structure 33 corresponds to corner positions of a molding cavity.

The gate structure 33 for filling sealing resin 25 into the cavity 26, as shown in FIG. 8, is eliminated after completion of the sealing process. This occurs before the resin package 12 is separated from the holding board 19A according to the process illustrated in FIG. 9 (see Honda at column 10, lines 63-67).

It is well known to those of ordinary skill in the art that a gate structure (flow gate) for filling resin into a mold is removed upon completion of a molding process. As discussed in Appellant's Amendment of January 2, 2004, a degating process conventionally is used to remove any gate structure.

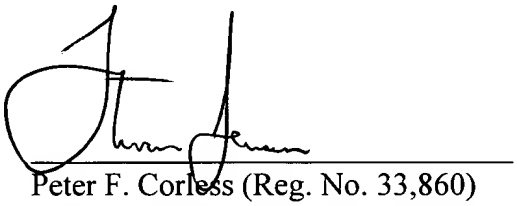
It is apparent from FIG. 9 of Honda that the semiconductor package does not include the "plurality of outwardly-extending portions" required by claim 8. Instead, after the sealing process, the resin package 12 of Honda has a trapezoid shape without any outwardly-extending portions in the semiconductor package (see FIG. 9).

As discussed above, the Honda reference does not teach or suggest a semiconductor package having an encapsulant "formed with a plurality of outwardly-extending portions" by a molding compound that fills in recess portions of a molding cavity. Therefore, even if Honda were somehow combined with Prior Art FIGS. 1-2 of the application, the proposed combination would still fail to teach or suggest the Appellant's claimed invention as recited in claim 8.

Because claims 9 through 12 depend from claim 8, which is allowable over the proposed combination, then claims 9 through 12 should also be in condition for allowance.

For each and all of the foregoing reasons, the Board is respectfully requested to reverse the Examiner's Final Rejection of claims 8-12 currently pending in this application, and to remand the application to the Examiner with instructions to pass the presently pending claims 8-12 to allowance.

Respectfully submitted,



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APPENDIX

8. A semiconductor package, comprising:

a substrate mounted with at least one semiconductor chip thereon and electrically connected to the semiconductor chip; and

an encapsulant formed by a molding compound injected into a molding cavity of a mold for encapsulating the semiconductor chip mounted on the substrate, wherein the molding cavity is formed with a plurality of recess portions at corner positions thereof, and the recessed portions are dimensioned to be relatively smaller in height than the molding cavity and are each connected to an air vent formed in the mold for interconnecting the recess portions and outside of the mold, such that the encapsulant is formed with a plurality of outwardly-extending portions by the molding compound filled in the recess portions of the molding cavity, and the outwardly-extending portions are located in positions corresponding to the corner positions of the molding cavity.

9. The semiconductor package of claim 8, wherein the semiconductor package is a BGA (ball grid array) semiconductor package.

10. The semiconductor package of claim 8, wherein the semiconductor package is a FCBGA (flip chip ball grid array) semiconductor package.

11. The semiconductor package of claim 8, wherein the molding compound is an epoxy resin having low viscosity, high fluidity and small fine filler size.

12. The semiconductor package of claim 8, wherein a molded underfilling technique is employed for injecting the molding compound.